NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

CONCEPT DEVELOPMENT OF THE
U.S. MARINE CORPS
PERSONNEL CASUALTY REPORTING SYSTEM

by

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March 1985

Thesis Advisor: William J. Haga

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A157330	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Concept Development of the U.S. Marine Corps Personnel Casualty Reporting System		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis March 1985
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Karen E. Riecks Douglas A. Musil		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943		12. REPORT DATE March 1985
		13. NUMBER OF PAGES 94
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution is unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Automatic Data Processing	Feasibility Study
Casualty Assistance	Life Cycle Management
Computer System	Mission Element Needs Statement
Database	Next of Kin
Economic Analysis	Requirements Statement

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This thesis encompasses the documentation required for the Concept Development phase of the Life Cycle Management for Automated Information Systems. The documents were produced during a requiremnts analysis conducted for the Casualty Section of Headquarters, U.S. Marine Corps in Arlington, Virginia during 1984 and 1985. The analysis concentrated on the

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S/N 0102-LF-014-6601

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20.

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Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
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Availability Codes	
Dist	Avail and/or Special
A1	

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Concept Development of the U.S. Marine Corps Personnel Casualty Reporting System

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MASTER OF SCIENCE IN INFORMATION SYSTEMS

from the

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ABSTRACT

This thesis encompasses the documentation required for the Concept Development phase of the Life Cycle Management for Automated Information Systems. The documents were produced during a requirements analysis conducted for the Casualty Section of Headquarters, U.S. Marine Corps in Arlington, Virginia during 1984 and 1985. The analysis concentrated on the information processing requirements of the Casualty Section during sustained operations and wartime. The purpose of this document is to influence the decision-makers to authorize continued development of an automated system to support personnel casualty reporting, notification, assistance, and recording for the U.S. Marine Corps.

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I. INTRODUCTION

A. BACKGROUND

The Casualty Section of Headquarters, U. S. Marine Corps is the focal point of all Marine Corps casualty information. It reviews incoming casualty reports, ensures proper notification of the next of kin, monitors the disposition of remains of persons for whom the Marine Corps is responsible, and provides appropriate assistance to survivors of Marines who become deceased or enter into a missing status. These responsibilities were met comparatively well until 23 October 1983 when 241 servicemen of the 24th Marine Amphibious Unit were killed in action in Beirut, Lebanon. As the media broadcast the details of the attack, the Casualty Section was whelmed with telephone inquiries from the general public, news reporters, other services, and agencies of the Federal government. Within four hours of the initial broadcasts, the amount of information demanded of the Casualty Section exceeded its ability to review and compile the data received from the field. This incident revealed major deficiencies in the Marine Corps' casualty reporting system.

B. OBJECTIVE

The objective of this thesis is to prepare four documents which are required by MCC P5231.1, the Marine Corps' summarization of federal requirements for new ADP systems development. These documents initiate the Concept Development Phase of the Life Cycle Management process for an automated information system for the Casualty Section, U. S. Marine Corps. The documents are (1) the Mission

Element Needs Statement, (2) the Requirements Statement, (3) the Feasibility Study, and (4) the Economic Analysis. Each of the documents will constitute a chapter of this thesis and, although they build upon each other, each is a self-contained document. In addition to the documents being submitted as a chapter of this thesis, each document is submitted to the cognizant section at Headquarters, U. S. Marine Corps (USMC). Proceeding through the life cycle development steps, the objective is a decision to either approve or disapprove an automated information system for the Casualty Section.

C. RESEARCH QUESTIONS

We posed the following research questions:

1. What are the mission deficiencies of the Casualty Section of Headquarters, U. S. Marine Corps, and is the exploration of alternative solutions justified?
2. Do the requirements of the Casualty Section contain sufficient quantitative and qualitative detail to validate the project?
3. How well do the alternative solutions satisfy the requirements in areas of operational, technical, and economic feasibility?
4. What is the relative worth of each feasible alternative in terms of costs, benefits, and uncertainties?

D. RESEARCH METHODOLOGY

The information presented in this thesis was obtained from current Marine Corps directives; interviews in person and telephonically with Marines and civilians working at Manpower Systems Integration and Procedures Section and at

the Casualty Section, HQMC; and research of previously written, similar documents.

E. SCOPE OF THE STUDY

The scope of the study for this thesis is to complete the concept development phase for an automated information system for the Casualty Section, HQMC. In order to accomplish this task, four documents are prepared as tools and presented to the Project Manager who will complete the staffing at HQMC, after which a decision is made whether to continue development.

F. LIMITATIONS

We were not colocated with the user nor the sponsor. Communication during the research was conducted via the telephone and during two onsite visits, one for orientation to the problem and the other for critiquing of the documents for accuracy of content as far as the user was concerned.

This was our first experience to write any of these four documents. Expertise in methodology and verbiage is limited.

A revision of the DOD Instruction 1300.9, specifying how an Active Duty Death Report (DD form 1300) is completed, is being written. Although it contains significant changes in how to complete the report, the changes are not reflected in the thesis due to the revision of the order not yet being signed.

The writers observed the Casualty Section during routine operations in which an average of four to five casualties are processed a week. Sustained operations offers a totally different environment of operation.

G. ASSUMPTIONS

A change in the capabilities of and the operating procedures at the Casualty Section was required; the status quo was no longer acceptable.

The range of alternative solutions offered a reasonable spectrum of available technologies.

H. ORGANIZATION OF THE THESIS

This thesis is organized so that each of the four documents constitutes a chapter. Chapter II presents the Mission Element Needs Statement (MENS). The MENS describes the deficiency and justifies the exploration of alternative solutions for satisfying that deficiency. Chapter III is the Requirements Statement (RS) and contains the functional requirements that the proposed system must satisfy. These requirements must clearly and accurately reflect those existing in the Casualty Section realizing that any future system will be designed to meet these requirements. The Feasibility Study comprises Chapter IV. The purpose of the Feasibility Study (FS) is to ascertain the operational, technical, and economic feasibility of the broad alternative approaches developed to satisfy the stated requirements. Chapter V contains the Economic Analysis (EA) which is a systematic approach to evaluate the relative worth of each alternative. The EA examines and relates the costs, benefits, and uncertainties of each alternative in order to determine the most cost-effective means of meeting the objective. Finally, Chapter VI summarizes the results of the work presented within the thesis. A glossary of abbreviations is contained Appendix A.

II. MISSION ELEMENT NEEDS STATEMENT

A. MISSION AREA IDENTIFICATION

1. Mission and Authority

The Casualty Section of the U.S. Marine Corps Headquarters provides the organizational capability for casualty notification, casualty assistance, individual casualty recording, and casualty reporting. This capability includes internal controls designed to ensure the accuracy of the casualty information for the purpose of certification as prescribed by DoD Instruction 1300.9 [Ref. 1]. The specific functions of the Casualty Section outlined in the HQMC Organization Manual [Ref. 2] are listed below.

1. Prepares and distributes official casualty reports to cognizant governmental agencies on death of active duty, Ready Reserve, and retired Marines
2. Directs and monitors the Casualty Assistance Calls Program for all active duty deaths
3. Conducts a limited Casualty Assistance Calls Program for survivors of retired Marines entitled to retired pay
4. Monitors the Marine Corps Decedent Affairs Program
5. Coordinates notification and decedent affairs matters for all overseas deaths
6. Advises field commands in the conduct of casualty notification and reporting
7. Prepares condolence letters for signature of the CMC of all active duty Marines, reservists who belong to an organized unit, and selected retirees

8. Coordinates initial notifications and progress reports to next of kin if residing outside the continental United States on casualties within the United States
9. Coordinates initial notification and progress reports to next of kin in the case of Marines overseas who are in a casualty status
10. Prepares official findings and recommendations to the Board of Review as to whether Marines who are carried in a "Missing" status should be continued in that status or declared dead
11. Coordinates appropriate military honors at funerals of Marines, dependents, and veterans in the Washington metropolitan area and group burials held in any National Cemetery; provides CMC representation and supervision for Marine funerals in the Washington metropolitan area; coordinates arrangements with participating Marine Corps and DOD activities; and assists in coordinating honors for Marines and veterans in any area in the United States on request
12. Prepares for signature by SecNav Certificates of Honorable Service in the case of deceased active duty Marines
13. In certain cases, determines whether wounds claimed by individuals were received in hostile action and makes appropriate certification to Decorations and Medals Branch
14. Provides, for Presidential use, the names and addressses of the the next of kin who die under honorable circumstances as the result of hostile action
15. Operates the Missing and Captured Personnel Unit for the Marine Corps
16. Administers the program for assistance to families of missing personnel

17. Prepares correspondence in response to inquiries regarding casualties
18. Reviews Service Record Book (SRB) or Officer Qualification Record (OQR) and investigative reports to ensure accuracy of casualty information in all records maintained
19. Furnishes certification of death of deceased members upon request
20. Advises and provides information to the Office of Servicemen's Group Life Insurance in any matters of record relating to coverage, beneficiary and settlement option designations
21. Determines the lawful recipient and certifies for payment the arrears of pay and death gratuity claims of beneficiaries of deceased Marines
22. Certifies eligibility of active duty Marines having required time in service for the Survivor Benefit Plan
23. Monitors the issuance by field commands of Notices of Eligibility to reservists for pay and allowances for periods of disability incurred during active duty for training
24. Determines entitlement and prepares Notices of Eligibility to reservists for pay and allowances for periods of disability
25. Reviews incoming Record of Emergency Data Microfiche and maintains an up to date file on active duty Marines for assistance in casualty notification and determination of beneficiaries for benefits
26. Reviews incoming Record of Emergency Data cards and maintains an up to date file on Marine Corps reservists
27. Prepares and compiles statistical data related to casualties to be maintained for internal use or in submission to other agencies as needed

28. Determines entitlement tc transportation for dependents of missing or deceased persons
29. Determines entitlement and prepares instructions relative to the shipment and/or disposition of lost, abandoned or unclaimed personal property and the personal effects and baggage of deceased and missing persons
30. Maintains accuracy and currency of Marine Corps regulations pertaining to the above functions with the exception of those pertaining to lost,abandoned or unclaimed personal property and the personal effects and baggage of deceased and missing persons
31. Sponsors MCO 5060.12 (Ceremony at Gravesite of Deceased Commandants), MCO P3040.4 (Marine Corps Casualty Procedures Manual), MCO 1741.8 (Government Life Insurance Manual), MCO 5360.8 (Military Funeral Support), and MCO 4631.2 (Transoceanic Travel for Next of Kin and Designated Family Member to visit Seriously Ill/Injured Marines/Civilian Employees of the Marine Corps)
32. In conjunction with the Separations and Retirement Branch and Reserve Personnel Branch, certifies the eligibility of dependents of deceased Reserve Marines for benefits from the Reserve Component Survivor Benefit Program

2. Current Environment

The Casualty Section, currently composed of twenty-six people organized into six functional units, is part of the Personal Affairs Branch of the Human Resources Division of Manpower at Headquarters, U.S. Marine Corps. The structure of the Section is depicted in Appendix B. Located at Henderson Hall, the section operates with a high degree of autonomy due to the time constraints of casualty

information. During off-duty hours, a senior member of the section is on call to initiate established procedures in the event of a casualty. During the recent mass casualty occurrence in Beirut, Lebanon the section was augmented with personnel from other organizations at Headquarters Marine Corps. The only form of autcmation within the Casualty Section is recently acquired word processing equipment.

3. Priority

Improvement of the mission capability of the Casualty Section is considered urgent.

B. DEFICIENCY

1. Scope

Several areas of deficiency are evident within the Casualty Section. First, the section is poorly equipped to handle any surge in the number of casualties above the average of four to five per week. This glaring deficiency (perhaps considered to be a wartime situation only) could be obscured in peace were it not for the memory of Beirut. Because no methods existed for handling a surge in casualties during the Beirut crisis, a manual system of record-keeping was implemented and maintained as shifts worked 24 hour days augmented (after time was taken to provide training) by other HQMC personnel. The Corps' time constraints were only made more evident by inaccurate notifications documented for the nation to view during evening news' interviews. In addition to its notification responsibilities, the section was whelmed with requirements to respond to the frequent yet varied requests from government agencies and the general public. Providing both accurate and timely information amidst all else could not be done [Ref. 3].

Second, while in most cases the identity of the next of kin is evident, frequent instances of recent marriages, divorces, unforeseen deaths, and other legal matters require that the initial notification of next of kin and determination of beneficiaries be accurate. Manual preparation of the DD Form 1300 (Record of Casualty, the military death certificate) requires a compilation of research from the individual's many records and becomes the Corps' determination of who will receive the death gratuity, pay in arrears, and SGLI payment.

Third, lack of information to identify and locate the next of kin and time spent in requesting and receiving old personnel records for a retired Marine who dies delays or prohibits notification and the payment of monies accrued.

In summary, the deficiency exists in (1) the present system being incapable of providing either notification to the next of kin or accurate and timely information to queries during any mass casualty situation, (2) the requirement to review a compilation of records to assure current and correct information, and (3) in cases of retired Marines, information identifying and locating the next of kin is not available resulting in time delays of notification and accrual of unpaid monies.

2. Jobs to be Accomplished

The following is a list of specific needs of the Casualty Section.

1. To improve the capability of the Casualty Section to obtain personnel data from current databases on active duty, reserve, and retired Marines
2. To provide the capability to efficiently record and store casualty assistance information not found in current personnel databases

3. To enhance the ability to develop casualty assistance management information
4. To support the determination of who will receive the death gratuity, pay in arrears, and SGLI payments

C. EXISTING AND PROGRAMMED CAPABILITIES

1. Current Capability

All information verification necessary to initiate the functions listed under Mission and Authority (paragraph II.A.1.) is completed through telephonic confirmation and/or visual review of printed matter. All information processing, including the preparation of all official documents, periodic reports, and responses to special inquiries is performed manually.

2. Programmed Capability

The programmed capability requested eliminates the regeneration of data by accessing database(s) which contain some of the information required by the Section and provides the Section with the means of efficiently accumulating information needed to manage casualty assistance in the Marine Corps. This capability will reduce the time required to verify pertinent information and will eliminate the risk of errors caused by the attempted duplication of data in the Real Time Finance and Manpower Management Information System (REAL FAMMIS). Another feature offers the improvement of the section's ability to provide rapid, accurate responses to various government agencies and the general public with casualty information. Expansibility is also considered key for the proper handling of reports during mass casualty incidents.

3. Impact

If the status quo is maintained, the Casualty Section will remain incapable of performing their mission during any mass casualty situation. A backlog will develop during verification which would delay the processing of casualty reports, survivor benefit information, and assistance. These delays will also inhibit the response to other government agencies and the general public on the status of their Marines.

D. CONSTRAINTS

1. Standardization

The exploration and acceptance of alternative solutions to the mission deficiency will proceed in accordance with applicable DOD, DON, and Marine Corps directives and standards. Since automated systems are closely involved in the programmed capabilities, adherence to MCO P5231.1 is required to ensure these standards are met [Ref. 4].

2. Interfaces

Wherever possible, any new information required by changes to the Casualty Section will be obtained from existing automated information systems. Any information now being supplied by the Casualty Section to other systems will be continued.

3. Logistical Limitations and Special Considerations

During 1985, the building in which the Casualty Section is located is scheduled to be replaced with a gymnasium. The future location of the Section, undetermined at this point, will impact on the possible procurement of any automated data processing equipment.

E. PROJECT MANAGEMENT

1. Steering Group

The steering group will only be convened to provide guidance for any problems that cannot be resolved through normal HQMC staffing procedures. The following steering group is established:

Chairman: Head, Manpower Management Information Systems Branch (MPI)

Members: Head, Personal Affairs Branch (MHP)
Head, Information Systems Support and Management Branch (CCI)

2. Project Team

The responsibilities for project management are considered part-time work for the project team and thus should be viewed as an additional duty for the team members. Since more than one functional area is involved, the development of a project manager charter by the project manager is directed. Approval for the charter rests with the Steering Group. The following project team is established:

Project Manager: Head, Manpower Systems Integration and Procedures Section (MPI-40)

Team Members: Representative from MHP
Representative from MPI
Representative from MCCDPA, Quantico

F. APPROVAL AUTHORIZATION

Director, Manpower Plans and Policy Division	Date
Director, C4 Systems Division	Date

III. REQUIREMENTS STATEMENT

A. GENERAL

1. Purpose

This requirements statement has a dual purpose. Primarily, it is the document which defines the user requirements for the Casualty Assistance Information System (CAIS). Secondarily, it provides the basis from which the Marine Corps will evaluate the need for further concept development of this system. This document has been reviewed by the potential users of the CAIS [Ref. 5] for the purpose of validating the user requirements. All comments from the review process have been incorporated in this document.

2. Point of Contact

Project Management for the CAIS is the responsibility of the Manpower System Integration and Procedures Section (MPI-40). The point of contact for this project is Captain J.N. Lott, (avn) 224-4115.

B. CURRENT SYSTEM

1. Existing System

a. Routine Situation

(1) The Personnel Casualty Report. The Naval message which reports the occurrence of a casualty initiates the work of the Casualty Section. All casualties, even when initially reported by telephone, are reported using a Naval message identified as the Personnel Casualty Report and formatted as prescribed in MCO 3040.4B [Ref. 6]. If the

casualty message is sent from an overseas command, the Casualty Section has the responsibility to initiate notification of the next of kin (NOK): both the primary next of kin (PNOK) and, in cases of death only, the secondary next of kin (SNOK). When a casualty occurs within the continental United States (CONUS), the reporting unit has the responsibility for notification. Figure 3.1 depicts the Data Flow Diagram for the existing system.

(2) Notification. The notification process begins when a unit learns that one or more of its members is a casualty. As stated previously, the Casualty Section becomes a link in the chain to notify the next of kin for occurrences of a casualty administratively attached to an overseas command. The Personnel Casualty Report (PCR) contains the following information:

1. Name
2. SSN
3. Grade/rate
4. Primary MOS
5. Type of Casualty
6. Casualty status
7. MCC/RUC
8. Category of person to be reported
9. Sex
10. Date of RED
11. Name/address/phone/relationship of PNOK and SNOK
12. Any NOK not to be notified
13. Place of incident
14. Circumstances
15. Line of duty investigation to be conducted
16. Status and location of remains
17. Cause of death
18. Place of death
19. Date/time group of death

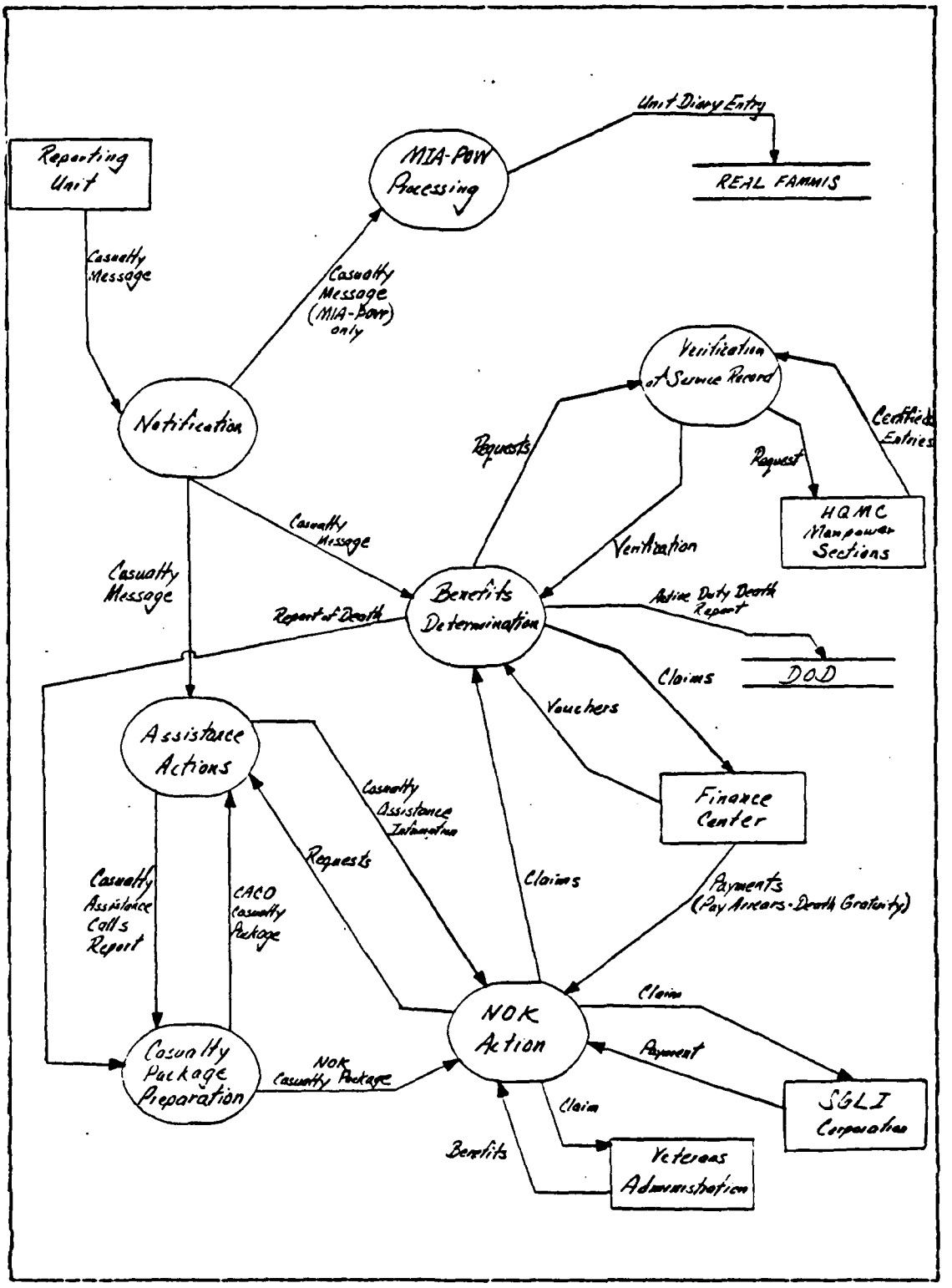


Figure 3.1 Data Flow Diagram

20. PEBD (Pay Entry Base Date)
21. Monthly amount of basic pay
22. Monthly amount of incentive pay
23. Monthly amount of special pay
24. Religious preference
25. Decorations and awards
26. SGLI recipients and date of signing
27. Date SGLI form sent
28. Diagnosis
29. Prognosis
30. Place hospitalized
31. Remarks
32. Category of missing person

As can be seen, the commander uses every available resource from the casualty's service record book to personal knowledge of the incident to send an accurate message. It is this information which is later passed to the next of kin. The importance of its veracity, timely receipt, and forwarding is evident. Information received from a CONUS unit in a casualty message is equally important. While the unit is responsible for passing the information on to the appropriate Marine Corps District (MCD), the unit also notifies HQMC and the Naval Medical Command.

From this point, the notification process is identical regardless of the unit to which the casualty is attached. Either HQMC or the command will notify the MCD in which the PNOK and/or SNOK (if notified in person) reside. The Marine Corps District will in turn notify the nearest Marine Corps Activity who will assign the Casualty Assistance Calls Officer (CACO) to make the casualty call. If a Marine becomes a casualty at the same location where he is attached, the local command will provide the CACO.

A casualty call is the Marine Corps' official notification to the primary and secondary NOK about the status of the Marine who is a casualty. It is made in person by a uniformed representative to the primary next of kin and secondary NOK (e.g., parents of a married Marine) except to those NOK whom, because of ill health, the casualty has previously requested not be notified. Following the casualty call, the CACO becomes the NOK's point of contact in all matters regarding the casualty pertaining to the Marine Corps. Frequent contact is made with the NOK by the CACO acting as a liaison, obtaining answers for questions, and in completing necessary forms.

(3) Benefits Determination. Each day, the administration unit of the Casualty Section forwards incoming Personnel Casualty Reports to various units within the section: Active Duty Benefits, Retired Benefits, and Reserve Benefits/Information Distribution. Having received the casualty message, the unit begins to prepare the Report of Casualty, DD Form 1300 and to determine beneficiaries for payment of the death gratuity and arrears in pay. The determination of benefits is made using the Marine's master fiche (HMF), his Record of Emergency Data (RED), his record book if received from the unit, and any other pertinent records. Each of the documents and determinations results in a legal document and payments to be made. In completing the DD Form 1300, current information on the Marine is requested from various other HQMC offices such as Decorations and Medals Branch to verify awards; the Promotion Branch to verify correct pay grade; Dependency Verification Department to verify the identity of the spouse, children, and parents; Staff Judge Advocate for any legal questions; and the Records Branch for any unresolved questions. Having verified all information placed on the DD Form 1300, the certificate is signed by the Head of the

Casualty Section or his assistant and forwarded to the Reserve Benefits/Information Distribution Unit.

Notification of the death of a retired Marine is received directly from the NOK or a family member, the Marine Corps Finance Center (MCFC), or from a Marine Corps activity. Upon receiving notification, the Retired Unit performs functions similar to that of Benefits Determination in making the determination of NOK for payment of pay in arrears. The case file of the deceased retired Marine is requested from the files stored in St. Louis. No CACO is assigned except in the case of general officers and under other special circumstances.

An on-going problem of lack of information or no accurate information on the identity or location of the NOK is evident in the storage of Record of Emergency Data cards for retired Marines. These are held only at the Casualty Section of HQMC, are not automated (the form completed by the Marine is on file), and only 30% of the REDs for retired Marines are on file.

(4) Casualty Assistance Package Preparation. Upon receipt of the Report of Casualty (DD Form 1300) for an active duty, reserve, or retired Marine, a process begins to prepare one or more casualty packages, depending on the relationships and number of the next of kin of the deceased Marine.

The Reserve Benefits / Information Distribution Unit sends a casualty package to the Casualty Assistance Calls Officer (CACO) designated to assist the NOK in all cases of an active duty death. The casualty package includes several copies of the Report of Casualty (the original is in the package sent to the NOK), a copy of the letter sent to the PNCK providing information about decedent affairs, all necessary forms for the NOK for benefits and monies due, and instructions to assist the NOK.

Concurrently, the Unit sends a casualty package to the PNOK which contains the original Report of Casualty with notarized copies, a statement indicating the of contact the NOK can expect from the CACO, and an information booklet on topics of interest to the NOK. Forms involving payments from the Marine Corps are returned to the Casualty Section; the others are sent by the NOK to the VA and SGLI. The Active Duty Benefits Unit receives from the NOK the Claim for Unpaid Compensation of Deceased Member of the Uniformed Services (SF 1174) for pay in arrears and the Claim Certification Voucher for Death Gratuity Payment (DD Form 397) if a local command has not already paid the Death Gratuity. These forms are then forwarded to the Marine Corps Finance Center for payment to the NOK and return of the voucher to the Casualty Section for filing.

For retired Marines, the casualty assistance package contains a different set of forms and instructions. Following receipt of the case file and determination of the NOK, a casualty package is sent to the NOK which includes the DD Form 1300, SF 1174 (Unpaid Compensation), various VA forms, an SGLI form if applicable, an information booklet, and an appropriate application for a new dependent's ID card. When the SF 1174 is returned from the NOK to the Casualty Section, it is forwarded to the MCFC for payment. A voucher is returned to the Casualty Section, indicating final payment, and filed in the case. The case is then closed, having taken two to five weeks for settlement.

(5) MIA/POW. With 292 Marines currently in a MIA/POW status [Ref. 7], this process is an administrative maintenance function. The MIA/POW unit assists the NOK of MIAs/POWs as required, answers correspondence, provides a monthly report to governmental agencies, and coordinates special events involving MIAs/POWs such as National

Recognition Day. During a conflict as MIAs/POWs are reported, this unit is tasked tc account for incoming information, assist in the notification of the NOK, and provide reports to the Department of Defense and the Department of the Navy.

(6) Administration. The administrative functions are supportive in nature for the Casualty Section. Functions include routing the incoming Naval messages reporting a casualty, monitoring controlled correspondence within the Section, paying funeral bills, maintaining adequate supplies, preparing correspondence, and doing special projects as required.

b. Mass Casualty Situation

(1) The Casualty Message. In the mass casualty situation, the requirement remains for a Naval message reporting the casualties. The initial message may only provide sketchy details of the event with follow up messages or other electronic means providing the specific information required in a casualty message. As in the Beirut bombing, other electronic means may be an on line data processing link over phone lines vice a Naval message via autodin (wire) because of the time sensitivity and delay using autodin. Regardless of the method used in the mass casualty situation, the Casualty Section will be notified and continually supplied with information.

(2) Notification. Because of the national publicity in a mass casualty situation (whether overseas or within CCNUS), the Casualty Section directs the notification vice only having cognizance as in the case of routine CONUS deaths. The entire notification process proceeds more slowly due to increased volume than in the case of a single casualty or routine types of casualty situations. Care is taken to assure primary identification of each casualty

(fingerprints or dental verification) even if secondary identification (name, SSN) has been made. Recovery of dental records and receipt of fingerprints from the FBI is necessary. Enbalming takes place, following recovery of any disconnected limbs if applicable, and the body is transferred (via a processing center in CONUS if the casualty site is overseas) to the mortuary requested by the NOK.

Following positive identification of each casualty and concurrent with medical processing, the same notification process as previously described for a non-mass casualty situation begins. It is at this point during a mass casualty situation that automation is absolutely necessary. When complete and timely transfer of casualty messages is not accomplished, notification is severly obstructed.

The critical nature of the mass casualty situation is that the NOK throughout the United States and the world, being made aware of the event by the media's coverage via television, radio, and newspapers, are contacting any office associated with HQMC or identified as Marine Corps (e.g. recruiting offices) with questions seeking information on "their" Marine. Not only is the Casualty Section subject to these inquires, but also Public Affairs, congressional offices, and other offices at HQMC. During this rapid-paced time frame, the Casualty Section is the one location containing the latest accurate information on each casualty. The "system" used for Beirut was butcher paper hung on the Casualty Section's walls containing names and status of the Marines, being updated with a grease pencil, and folders brimming with messages and pages of cryptic information. Thus was the "database" formed from which notifications were made and the public and Congress informed [Ref. 8].

(3) Benefits Determination. The determination of benefits during a mass casualty situation is a similar process as for the single casualty. The problem, as in any aspect of mass casualties, is meeting the volume requirements while being constrained by time. Before the Report of Casualty and casualty packages can be completed, the beneficiary(ies) must be determined. The complexity of this task is compounded by increases in the number of casualties, requiring that the same staff complete a greater number of beneficiaries and casualty packages to mail to the NOK in the same amount of time as for a single casualty.

(4) Casualty Assistance Package Preparation. Just as an increased number of casualties requires the identification of more beneficiaries within a given amount of time, so too the increased number of casualties requires the compilation and mailing of more casualty packages within a given time.

(5) MIA/POW. During a war-related mass casualty situation, this process is required at its maximum extent. Casualties are continually reported in an MIA or POW status. As stated previously in a mass casualty situation, the MIA/POW unit accounts for all information regarding MIAs/POWs, assists in notification, and provides required reports. In a non-war related situation, MIAs are reported as such until another status is confirmed. Following notification of the receipt of MIA/POW status, the MIA/POW unit begins the notification process discussed earlier for a single casualty. The unit has the responsibility of maintaining accurate lists and information regarding all MIAs/PCWs.

(6) Administration. In the mass casualty situation, administration bears an increased volume in the amount of its routine work. Areas of greatest increase are incoming Naval messages reporting and updating casualties

and the volume of telephonic inquiries and updates which constantly require attention. All personnel in the Section and those augmenting the Section during a crisis are called on to answer telephones and to do other administrative tasks. The task of telephonic communication with other Marine units, the Departments of the Navy and Defense, Congress, the public, and relatives becomes the primary task and cannot be automated because of the personal nature of the calls and questions.

2. Problem Description

In describing the existing system in the preceding paragraphs during a mass casualty situation and as summarized in the Mission Element Needs Statements (MENS), three areas of deficiency exist:

1. Notification of the next of kin
2. Concurrent requests for information
3. Maintenance of information on retired Marines

First, notification of the next of kin in an accurate, timely manner is severly constrained by the present system as was evidenced during the Beirut crisis. Not only was information on each casualty being transmitted on a slower than usual basis for casualty notification, but also the handling of the information within the Casualty Section slowed.

Secondly, providing a single database with all information on each casualty in a mass casualty situation allows the Section to compile records with the most current information. This database will then serve as a source to answer the myriad of questions at the rapid pace which is levied. A database also allows many individuals who have requirements to use the information the ability to do so concurrently.

Finally, there is a prcblem regarding the Record of Emergency Data which is missing in approximately 70% of the cases for retired Marines. The RED is a source document for beneficiary and notification information in the event of an individual's death and is held by the Casualty Section. All bits of information which the Section receives during the years following the Marine's retirement should be able to be maintained in order to locate the PNOK or SNOK if no RED is available or incorrect information is discovered when a Marine dies. Mass storage would be required to correct the deficiency in this way. An evidence of this problem is the fact that the Marine Corps Finance Center is currently holding a fund for all the unpaid monies due the NOK in cases when location or identification was not known.

C. REQUIRED CAPABILITIES

1. Capability Identificatcn

a. Functional Requirements

The functional requirements of an automated information system for the Casualty Section are to accept alpha-numeric and narrative information about personnel casualties, maintain such information for a specified period of time, and allow rapid access to such information for support of the varicus missions of the Casualty Section outlined in the Mission Element Needs Statement.

b. Specific Capabilities

The specific capabilities of the system encom-pass four major areas associated with the missions of the Section. The four processes being evaluated are reporting, notification, assistance, and recording.

(1) Casualty Reporting. This process accepts all data associated with a casualty or group of casualties and builds a database of records. Each record must contain data for one and only one casualty. The data contained in the Personnel Casualty Report, items 1-33 shown in Appendix C, are the foundation from which the database records will be constructed. The Personnel Casualty Report is normally received by the Casualty Section via a Naval message and is verified as being factual by the commander responsible for submitting the report. This process will be expanded to allow automated data entry from multiple locations around the globe across existing telecommunication lines. This multiple entry capability will allow the automated record to be created in the field and then immediately be transmitted to the Casualty Section for processing. To process PCRs rapidly and accurately, the Casualty Section uses the JUMPS/MMS database. The need exists for the Section to have the ability to electronically transfer personnel data from current databases to the CAIS. These capabilities are required to decrease the time of initial reporting by reducing the successive re-typing of information currently required to generate the Naval message and also create a case file at HQMC. Although the Naval message will remain the standard means of reporting casualties and will not be superseded by this new capability, specific units may be equipped to electronically transmit the initial report data directly to the Casualty Section.

This process must also allow additions, changes, and deletions to each record or group of records as changes are received by the Section (e.g. a change in the location of remains). As the Section receives reports from the field, many users in the Section may be required to input data simultaneously. Likewise, one user may need to input the same data to several records at one time when

there exists a commonality of information about several casualties.

(2) Notification of Next of Kin. This process appends to existing database records all data required to initiate and/or monitor the notification of both primary and secondary next of kin. The additional information is used to identify the specific organizations and individuals who are tasked with relaying casualty information to the NOK. Included in this process is the ability of each Marine Corps District Headquarters to electronically transmit and receive data which corresponds to the notification of the NOK. This process is required to reduce the volume of voice communication and message traffic to and from HQMC in the interest of saving time. The primary intent here is to distribute more current information to the CACO, via the MCD, for the purpose of relaying casualty information to the NOK. Secondly, this distribution will diminish the role of the Casualty Section, from the NCK's standpoint, since many questions could be satisfactorily answered at the District vice HQMC level. This process will add the following elements to each record as the data become available.

1. The Marine Corps activity nearest to the PNOK
2. Marine Corps District of the activity assigned
3. Name, grade, unit, work/home phone numbers of CACO 1
4. Name, grade, unit, work/home phone numbers of CACO 2
5. Name, grade, unit, work/home phone numbers of CACO 3
6. Date of confirmation Mailgram/telegram/letter from HQMC
7. Consecutive narrative updates received from the CACO

(3) Assistance to Next of Kin. This process will accept and append data to the existing database records regarding the movement of the service member's remains to the place of interment. The Section will be informed, via

the CACO, of the family's desires regarding the assignment of escorts who are to accompany the body and the location of interment. This information is used by the section to coordinate the transportation and funeral arrangements. The following data are minimal requirements to support this function and will be entered by the Casualty Section or MCD as they are identified.

1. Special requests from the NOK concerning the funeral
2. Name, unit, and phone number(s) of escort(s)
3. Name, address, phone number of mortuary
4. Date and location of interment

This process also accepts and appends data to the existing record regarding survivor identification and eligibility for monetary benefits. This information is used by the Section to trigger the manual processing of forms required to initiate payments. Therefore, each entity must reference the document from which the information originated. The following data are the minimal requirements for this action and shall be entered by Casualty Section only.

1. Name, address, phone number of death gratuity beneficiary, source document, date and amount of payment
2. Name, address, phone number of arrears in pay beneficiaries, source document, date and amount of payment
3. Name, address, phone number of SGLI beneficiary(ies), source document, date and amount of payment

(4) Casualty Recording. This process will allow retrieval of one or more data elements from one or more existing records to produce information required for periodic reports and ad hoc queries. This process will not add, change, or delete data contained in the records. The purpose of this process is to allow a user-friendly means of retrieving information stored in one or more records. Users

in the Section must be able to obtain this information rapidly and in a format suitable to their specific needs. Without describing the method of inquiry, the arrangement of output, or performance bounds, the following functions will require use of this process. These functions are examples, not to be interpreted as the only functions requiring read-only type of access to the database.

1. Filling out official forms
2. Compiling data for periodic reports
3. Completing official correspondence
4. Responding to telephonic inquiries
5. Performing statistical analyses
6. Maintaining historical records

2. Organizational Structure

a. Structure

The organization for which these requirements are defined is the Casualty Section (Code MHP-10) of the Personal Affairs Branch of Manpower Division at Headquarters, U.S. Marine Corps. The Section is currently located at and will probably remain in the vicinity of the Marine Corps Headquarters in Arlington, Virginia. The Section contains seven units which vary in size and composition depending upon the tempo of operations. The organization chart depicted in Appendix D indicates the structure of the Section, billet titles, and quantity of personnel. This chart is based upon the manpower needs of the Section during sustained operations and may not reflect the current configuration of the unit.

b. Unit Description

The name of each unit of the Casualty Section along with a brief description of its contribution to the mission are provided below.

1. Notification - Initiates the notification of next of kin for overseas commands and is the cognizant agency for the notification process initiated by stateside commands and monitored by the MCDs
2. Active Duty Benefits - Identify the legally declared recipient of benefits and monies accrued of a casualty
3. MIA/POW - Provide administrative control and reporting responsibility for personnel whose status changes to Missing in Action or Prisoner of War
4. Administration/Funeral Support - Prepare correspondence considered non-routine and provide clerical assistance to the Funeral Director of the Marine Corps
5. Reserve Benefits/Information Distribution - Certify eligibility of reserve members to receive monetary compensation for injuries sustained while serving in a duty status and prepare casualty packages
6. Retired Benefits - Identify the legally declared recipient of monies accrued to the deceased service member who was retired
7. Transportation / Escort / Disposition - Provide Invitational Travel Orders to appropriate family members, control the assignment and travel of escorts, and monitor the return of remains to the final destination

3. Interface with Other Systems

Currently no requirement exists for this system to interface with any other existing automated information system.

4. Operating Environment

This host system must operate in an office setting with normal interior temperatures and humidities. It is not expected that wartime requirements will affect movement of the main system to a dissimilar environment.

5. Communication Requirements

Communication requirements must support the functional requirements of the units to use the system for data entry, ad hoc retrieval of data, and output generation. As of this writing, all new communication requirements are internal to the Casualty Section system. Remote I/O equipment will be required to use existing communication facilities for interaction with the host system. Internal communication support must be easily expansible to accommodate a rapid increase in the number of users (i.e., during a mass casualty incident or sustained operations).

6. Classification

The Personal Casualty Report and associated data contains information which requires special handling due to the Privacy Act of 1974. Data which is classified (e.g., messages containing SECRET information) must be handled separately.

7. Data Volume

a. Purpose

The statistics asscciated with this study are based upon historical informaticn and are presented here as a preliminary calculation of data volume. This calculation is necessary to evaluate alternative computer system's capabilities during the feasibility study.

b. Characteristics

The volume of data corresponding to a single casualty is not an absolute value. A Personnel Casualty Report will contain varying amounts of information; one may be succinct while another may be quite long. The number of PCRs generated per month will also be variable, depending upon the circumstances in which the Marine Corps is operating. To arrive at a reasonable size for the data storage requirements of the CAIS, two characteristics must be numerically defined: record size in bytes and record volume per month.

(1) Record Size. 12,000 bytes would be sufficient to represent the information contained in one record for one casualty based on the record field sizes listed in Appendix C.

(2) Record Volume. 1,000 records per month would be created based upon the average frequency of casualties which occurred monthly during World War II and the Korean and Vietnam Conflicts [Ref. 9] as shown in Appendix E.

c. Summary

The average data volume being generated per month during sustained operations is 12 megabytes. Based on the past history of cases completed by the Casualty Section, a record would be archived 90 days after its creation [Ref. 10]. Therefore, at any given moment, the volume of active records in the CAIS may require 36 megabytes of external storage.

8. Performance Requirements

Many of the input and output requirements must occur within several seconds as the database will be the trigger

for several manual activities which must be initiated as soon as the information becomes available. A rapid response time will satisfy the functicnal requirements listed in paragraph C.1.b. of this Chapter. Periodic reports of a routine nature will nct require the rapidity of ad hoc query responses. Such reports may be produced several hours after the request.

9. Requirements for a Backup Capability

Continuity of operations including the capability to operate 24 hours per day for several days at a time is required. Protection must be provided to ensure the integrity of the database. Therefore, a high degree of hardware and software fault tcleration must be built into the design of this system.

D. VALIDATION OF REQUIREMENTS

The Deputy Chief of Staff for Manpower at Headquarters, U.S. Marine Corps has directed immediate action toward implementing an autcmated information system to handle the requirements of the Casualty Section. This direction is based on current deficiencies cf the Section which became evident during the Beirut crisis. The responsibilities of the Section are sufficiently critical to warrant a sophisticated means of handling the information resources created during mass casualty cccurrences during war or peace.

IV. FEASIBILITY STUDY

A. INTRODUCTION AND GENERAL INFORMATION

1. Purpose

The purpose of this Feasibility Study (FS) and the Economic Analysis (EA) which follows is to present the results of an analysis of alternative approaches to satisfy the user requirements set forth in the Requirement Statement for the Casualty Assistance Infcrmation System (CAIS). The Feasibility Study also identifies alternative approaches which are technically and operationally feasible to satisfy the requirements. The objective of the Economic Analysis is to evaluate the alternatives' comparative life-cycle costs. Both costs and benefits are then examined for each feasible alternative to select the recommended alternative.

2. List of Alternative Approaches

The following is the list of alternative approaches evaluated in this Feasibility Study:

1. Combination system of a minicomputer and a mainframe
2. Ccmbination system of microcomputers and a mainframe
3. Combination of microcomputers
4. Existing System (manual and word processing)
5. Mainframe only
6. Minicomputer only

3. Content

a. Recommendation

Three alternatives are recommended for further analysis. These systems are the combination of a minicomputer and mainframe, the combination of microcomputers and mainframe, and microcomputers. This Feasibility Study provides descriptions of all the alternatives considered as well as the criteria used to determine feasibility.

b. Other System Considerations

The existing system is considered not feasible. Although it has limited word processing capability and the possibility for a database management system, its unresponsiveness in a mass casualty situation and integration with any other system in the Marine Corps is unworkable, especially in a mass casualty situation.

Alternatives of a mainframe in combination with a minicomputer or microcomputers were considered because of the accessibility and availability of a mainframe at the Marine Corps Development and Education Command (MCDEC), Quantico, VA and in a lease situation in Rockville, MD. If a mainframe were not already available, a mainframe would not have been considered as feasible alternative because of the cost consideration.

4. Problem and User Requirements

Previous documents provide preliminary information. The Mission Element Needs Statement contains a statement of the problem and the Requirements Statement sets forth user requirements.

5. AIS Guidelines and Constraints

All pertinent guidelines and constraints have been incorporated in the MENS.

6. System Title

Upon approval of this document, the new system will be named the Casualty Assistance Information System (CAIS).

B. FEASIBLE ALTERNATIVES

1. Background

Of the six alternative approaches, three are considered feasible alternatives and selected for consideration as possible means of satisfying the requirements of the Requirements Statement (RS). These three feasible alternatives are described in detail in this section. The following section contains descriptions of the infeasible alternatives. The feasible alternatives are as follows:

Alternative 1: minicomputer and mainframe combination
Alternative 2: microcomputer and mainframe combination
Alternative 3: networked microcomputers

2. Description of the First Recommended Alternative

This alternative consists of a minicomputer operating in conjunction with the mainframe computer system located at the Marine Corps Central Design and Programming Activity (MCCDPA) in Quantico, VA.

a. Concept

Under this alternative the CAIS is fully automated through the use of a distributed computer system. Jobs, submitted by users via keyboard type terminals, may be

processed on-line or in a batch mode. All significant processing will take place in either the minicomputer or the mainframe, the selection of which being transparent to the user. All data are assumed to be replicated, although no responsibility is implied at this point as to which processing node maintains the master copy. Output will be transmitted to the user's video display monitor or high speed printer. Communications between the input/output (I/O) devices at remote locations and the processing nodes will utilize standard equipment (e.g., modems) capable of transmitting and receiving signals over common telephone lines. Inherent to this approach in satisfying the users needs is the capability of using the minicomputer as a back-up for the mainframe and vice versa.

b. Inputs

Inputs will originate from user's terminals in three types of organizations which are dispersed around the globe: major field command headquarters, Marine Corps District Headquarters, and the Casualty Section at HQMC. Entire files, records as well as data elements may be the content of one input session. During subsequent phases of system development, detailed explanations of these inputs and their interrelationships will be provided.

c. Outputs

The outputs of the CAIS will be presented to the users described above via their video display monitor or high speed printer. The output may be in the form of files, or records, or single data elements.

d. Software

The software emplcyed by the CAIS must be capable of integrating the fcllowing services intc the computer system:

1. Communication control to allow authorized users access to the system from multiple local and remote terminals for I/O processes
2. Interactive database management system utilizing an English- like query language
3. Report generation based upon user specified parameters
4. Full screen text editing
5. File transfer
6. Audit trail reporting

e. Equipment

The hardware associated with this approach is listed in generic terms in Appendix F.

3. Description of the Second Recommended Alternative

This alternative consists of microcomputers and a mainframe combination. The microcomputers and remote terminals would be located at various units (see paragraph b. below) while the mainframe is located at Quantico, VA.

a. Concept

This alternative is fully automated with all aspects of the system distributed and processing either in an on-line or batch mode. Users will enter data via a keyboard terminal at various input centers throughout the country. Users will primarily be creating or updating a record within a database or reading new information from a created or updated record. Nodes function as both inputs and outputs, depending on the user's needs. Output devices include either a video display monitor or a high speed printer. Both the microcomputers and the mainframe can be used as backup hardware in the event of equipment failure.

b. Inputs

Input will be entered by the user and will initially be a record of specified data regarding a casualty. Following the initial input, data elements within a record will be updated. Terminals will be located at the Casualty Section, HQMC; Marine Corps District Headquarters; and major field command headquarters.

c. Outputs

Outputs of the CAIS will include individual or multiple records and reports produced either on the user's monitor or printer. Because of the single database accessed by all users, input and output can be generated for one record by several users. For example, a major command will input a record on a casualty, Casualty Section may display or print the record, and the Marine Corps District update with information from the Casualty Assistance Calls Officer for both the Casualty Section and the major command.

d. Software.

See paragraph B.2.d. above.

e. Equipment

The hardware used in this alternative runs the gamut of computer hardware from a mainframe to a microcomputer. The mainframe is an Amdahl 470/V7 computer located at the Marine Corps Central Design and Programming Activity, Quantico,VA. Microcomputers, which must be purchased, would include a monitor/keyboard as a unit or separate devices; high speed modem; storage of either two disk drives or a hard disk and a single disk drive; a high speed, letter quality printer; and be compatible with other Marine Corps hardware. Each major field command and Marine Corps

District would have input/output devices as described. The Casualty Section will have 10 monitor/keyboard combinations and four printers. See Appendix F.

4. Description of the Third Recommended Alternative

This alternative consists of two or more microcomputers within the Casualty Section. In addition, input/output devices would be located at units throughout the Corps.

a. Concept

This system provides for a linked network of microcomputers and input/output devices at the Casualty Section, the major field commands, and at the Marine Corps Districts. The distributed system would provide on-line input and multiple entry and output points via the microcomputers terminal/display or printer.

b. Inputs

See paragraph B.2.b. above.

c. Outputs

See paragraph B.2.c. above.

d. Software

See paragraph B.2.d. above.

e. Equipment

The microcomputers must be configured as described in paragraph 3.e. above with the additional capability of being networked together so several users can use the computers, each with separate terminals from various locations.

C. OTHER ALTERNATIVES

1. Background

This section describes the alternatives which were analyzed but not reccmmended for further conceptual development and analysis.

2. Description of the Existing System

The existing system is virtually a manual system with one addition. Input is received via the Naval message or telephone at which time a file is begun and updated until the case is completed. Communication with the units is accomplished over the telephone or with a Naval message. The automated portion of the present system is an ABDick system consisting of four CRTs, two CPUs, and two printers. The system is used for some word processing and Mailgram service.

a. Concept

The system becomes unmanageable with mass casualties for there is no automation or incorporation of current computing capabilities.

b. Inputs

Files are begun and maintained on paper in a manila fclder and updated by hard.

c. Outputs

Reports and forms are prepared by hand and typed as necessary except Mailgrams, which are sent using a capability of the ABDick system and Western Union.

d. Software

The database management system package FMS-80 was purchased for the ABDick machine and is inoperable at this time. This is due both to inaccurate programming for the user's needs when initially installed and also to lack of skilled programmers and users in the vicinity. However, a greater potential issue is that the FMS-80 is not compatible with any Marine Corps application and could not be linked or networked except to identical systems.

e. Equipment

Although the ABDick hardware can perform some word processing, it is not a computer system capable of meeting the CAIS requirements.

3. Description of Second Nonrecommended Alternative

The CAIS is fully automated using the services provided by the mainframe computer system at the MCCDPA in Quantico, VA.

a. Concept

Under this alternative, all significant processing would be performed by the Amdahl 470/V7 computer which is currently in service. The system is assumed to be complete with system software, utility programs, and a database management system (DBMS) capable of supporting the CAIS requirements. Users will interact with the system via remote terminals located at major field command headquarters, Marine Corps District Headquarters, and the Casualty Section. Processing may be interactive or batch depending upon the type of job submitted and the policy of the computer center. All output must be generated electronically to the user's location for display on a video monitor

and/or hard copy printout. Data communications between the I/O devices and the computer will rely on standard communication equipment designed for use with voice-grade telephone lines.

b. Inputs

See paragraph B.2.b. above.

c. Outputs

See paragraph B.2.c. above.

d. Software

ADABAS, a comprehensive DBMS is operating at the MCCDPA and appears to be sufficient for the CAIS requirements. Also see paragraph B.2.d. above.

e. Equipment

The hardware components for this configuration are listed in the appropriate columns of Appendix F, except the Casualty Section would not maintain a minicomputer or disk pack. The communication channels available for use by the CAIS have not been identified and the possibility exists that these lines at the MCCDPA will have to be augmented to support the multiple users.

4. Description of the Third Nonrecommended Alternative

This approach would automate the CAIS by implementing a single minicomputer which could be located at the Casualty Section.

a. Concept

With this alternative, processing is performed in a minicomputer which is capable of accessing some form of secondary storage. Multiple I/O devices would be linked to

the system allowing users to submit jobs and receive output from local as well as remote locations. The concept is similar to the previous alternative, except the host is a minicomputer capable of performing the same services to the users.

b. Inputs

See paragraph B.2.b. above.

c. Outputs

See paragraph B.2.c. above.

d. Software

See paragraph B.2.d. above.

e. Equipment

The hardware necessary to construct this system is listed in Appendix F, except the MCCDPA and its associated equipment would not be included.

D. FEASIBILITY DETERMINATION

1. Purpose

The characteristics used to evaluate the adequacy of each of the six alternatives are general in nature. Their meaning is described below to amplify the criteria by which the alternatives will be considered for further conceptual development. The recommended alternatives will then be subject to a Cost/Benefit Analysis, found in the following Chapter.

2. Technical Feasibility

The technical characteristics necessary to construct a successful computer system for the proposed users of the CAIS follows.

a. Hardware

(1) Memory. Sufficient data storage locations must be available to handle the applications and associated data upon which they operate. The central processor must be capable of accessing 36 megabytes of data which may reside on a secondary storage device such as a hard disk.

(2) Access. The use of shared equipment must allow the Casualty Section priority over other users in the event of an emergency involving a significant number of casualties.

(3) Flexibility. The configuration of the physical hardware elements must be adaptable to Casualty Section re-organization, especially a rapid increase in the number of I/O devices communicating with the host computer during mass casualty incidents.

(4) Fault Toleration. The hardware components must be designed and organized to perform database management functions continuously for several days at a time. A degraded or inoperable host processor must not bring the entire CAIS to a halt.

(5) Design History. Equipment must be proven through consistently good performance which has been documented in similar operating environments.

(6) Availability. The components and repair parts are readily available from commercial or government sources.

(7) Longevity. The hardware is state-of-the-practice meaning it is technologically current with an eight year life expectancy before it is considered obsolete.

b. Software

(1) Applications. The various applications of software must be able to be integrated together to provide

the user with all services appropriate to the CAIS requirements listed in the Requirements Statement.

(2) Response Time. Simple queries and database updates must be processed within six seconds to meet the needs of local users submitting on-line jobs. This means six seconds from the time a user submits a simple query to the moment the user is provided an answer to the query.

(3) Transportable. The programs must be executable on hardware commonly used in Marine Corps non-tactical applications.

(4) Maintenance. The programs and associated documentation must be maintainable by the vendor throughout the eight year life cycle of the CAIS.

(5) Human Interface. The conduct of the program as it prompts the user must be easily understood by users unfamiliar with computer-ease terminology and must offer adequate help facilities at the terminal and in print.

(6) Availability. The software along with its documentation must be readily available through commercial or government sources.

c. Communications

(1) Compatibility. Logical data communication between components must be easily incorporated in standard equipment such as modems and controllers.

(2) Availability. The components required to ensure dependable data communication for this system are available through commercial or government sources.

3. Operational Feasibility

The operational concerns affecting the determination of which alternatives are feasible are described next.

a. Strategy

The system must meet or exceed the goals specified in the Requirements Statement to implement the data processing strategy of the Casualty Section.

b. Personnel

The CAIS can be successfully implemented with this system considering the qualifications and experiences of the people who will operate the CAIS.

c. Policy

The current DOD, DON, and USMC policies concerning casualty reporting can be easily incorporated into the procedures of the CAIS.

d. Flexibility

The CAIS can accommodate organizational restructuring or expand to include new users as they are identified.

4. Analysis of Alternatives

To determine the feasible solutions, each of the six approaches were examined against the technical and operational issues. Once an alternative failed to meet the criteria of any one characteristic, that alternative was labeled infeasible. The results of these examinations are listed in Appendix G. Next are brief summaries about each of the alternatives considered in this study.

a. Alternative 1 - Minicomputer / Mainframe

This alternative is considered feasible as it satisfies all the issues considered. The configuration of this distributed system has been well established in many governmental and commercial applications.

b. Alternative 2 - Microcomputer / Mainframe

This alternative is feasible for the same reason as above. Many micrccomputers are approaching some of the performance characteristics of low-end minicomputers.

c. Alternative 3 - Networked Microcomputers

This alternative is feasible and meets all requirements without dependence on any other computer system.

d. Alternative 4 - Existing System

This alternative was proven to be infeasible during the mass casualty situation in Beirut. Response and timeliness were major problem areas.

e. Alternative 5 - Mainframe only

This approach is infeasible due to the lack of back-up capability for the host processor. Without a sufficient back-up capability in the event of an interruption in processing, the CAIS would not meet the user's requirement of continuous operations for sustained periods of time. Also, in the event of sustained operations, Casualty Section cannot be assured of dedicated access to a shared resource.

f. Alternative 6 - Minicomputer only

This alternative is infeasible for the same reasons applied to alternative 5.

V. ECONOMIC ANALYSIS

A. INTRODUCTION

1. Background

Recognizing the need to improve the information processing capability of the Casualty Section, the Marine Corps initiated concept development of a Casualty Assistance Information System. An Economic Analysis is required by MCO P5231.1 and concludes the concept development phase of the life cycle management process.

2. Scope

The scope of this analysis is limited to addressing benefits and recurring and non-recurring costs associated with three feasible alternatives designed to meet the needs of the CAIS.

3. Methodology

The analogy method of cost estimation [Ref. 11: p. 5-3] was selected as the primary tool for this Economic Analysis. Cost information is readily available for several commercial products which are suitable for this application. Next, a group of benefits were defined for the feasible alternatives to provide a basis for evaluation of each alternative. To reduce any bias of the authors in judging benefits, a panel of five individuals was employed to grade the relative worth of each benefit expected from each alternative. Panel members were selected for their advanced knowledge of computer technology and their disassociation with the choice of an alternative subsequent to this study. Because this analysis considered solutions whose costs and

benefits are unequal, the Benefit Cost Ratio (BCR) was used to represent benefits obtained per unit of cost for each alternative. The BCR indicates the relative cost effectiveness of each feasible approach.

B. OBJECTIVE

The objective of this Economic Analysis is to examine the cost effectiveness of the three alternatives recommended in the Feasibility Study for further conceptual development. The results of the Economic Analysis will be used by Marine Corps decision-makers who will select one alternative to satisfy the CAIS requirements.

C. ASSUMPTIONS

The assumptions which were used as boundaries for this analysis are listed next.

1. The economic life of the system is eight years from the date of full implementation
2. ADP will be purchased, not leased
3. All system development costs to date are considered to be sunk costs
4. Costs which are relatively consistent for all three alternatives are listed as common costs but are not used further in the comparison. These include:

    a. Input and output equipment
    b. Data communication devices
    c. Secondary storage devices
    d. CAIS application programs
    e. Maintenance of the above items
    f. Consumable supplies
    g. Electrical power
    h. ADP personnel assistance
    i. User training programs

5. The base year for the cost analysis is FY 85

D. ALTERNATIVES

1. Current System

The Casualty Section is processing incoming infcrmation using a manual system which is considered infeasible. Hence, there is not a baseline from which to gauge the proposed automated systems. The inadequacies of this alternative are presented in detail in Section C of the Feasibility Study.

2. Proposed Systems

Of the remaining five alternatives, two are infeasible due to technical limitations and will not be described in this analysis. The three feasible alternatives, explained at length in Section B of the Feasibility Study, are summarized below.

a. Alternative 1 - Minicomputer / Mainframe

This alternative would integrate the services of a miniccmputer system with the Amdahl 470/V7 mainframe system at the MCCDPA. This integration would create a semi-fault tolerant database management system for processing casualty information. Either computer would be capable of communicating with Remote Job Entry equipment for input or output processing. Data would be replicated and accessible to either computer's DBMS and the CAIS application software.

b. Alternative 2 - Microcomputer / Mainframe

This apprcach differs from alternative 1 only by the use cf a microcomputer instead of a minicomputer. The remaining characteristics of this approach are identical to alternative 1.

c. Alternative 3 - Networked Microcomputers

This approach would create a distributed system through the integration of two or more microcomputers which would access one database. Any of the computers would be capable of processing input/output requests, thereby establishing a semi-fault tolerant system. Data, the DBMS, and the application software would be placed in a secondary storage device to which all computers would be linked.

E. COST ANALYSIS

The technique used to estimate costs for each feasible alternative was the analogy method. This approach provides a direct substitution of costs of similar products or services. The analogy method was considered an appropriate tool because of the array of off-the-shelf products which could satisfy the CAIS over an eight year life. Many costs, such as remote input/output devices and supplies, did not significantly vary by alternative and, therefore, are not used in the analysis. Likewise, sunk costs, such as the Defense Data Network (DDN), are not included [Ref. 12: p. 3-4]. The only costs displayed here are those which significantly vary among alternatives. The cost elements, categorized as either non-recurring (one-time) or recurring (periodic) are described next.

1. Non-recurring Costs

a. Equipment Purchase

This cost element reflects the October 1984 market price of computer hardware [Ref. 13], which includes a central processing unit, main memory, operating system, and installation. The cost asscciated with each alternative is for multiuser/multiprogramming equipment, but does not include peripheral devices.

b. Software Purchase

This cost element indicates the October 1984 market price of a database management software product [Ref. 14] which will perform in a multiuser environment with the operating system of the equipment specified for that particular alternative.

2. Recurring Costs

a. Equipment Maintenance

After the first year of operation, equipment maintenance costs are paid by the owner at an average rate of 10.3% per year of the original equipment cost, as estimated by MPI-40 (HQMC) analysts [Ref. 15]. This percentage applies to the remaining years of the CAIS life cycle.

b. Software Maintenance

The cost element for maintenance of the database management software also extends from the year following implementation to the end of the CAIS life cycle. The yearly maintenance fee for the software product of alternative 1 is a standard price for that product or 15.8% of the original purchase price. For the products used in alternatives 2 and 3, no standard maintenance fee is specified by the vendor although similar products are maintained on a yearly cost of 12-30% of the original purchase price. The higher of these two values was used in this analysis to estimate the annual cost of maintaining the DBMS for alternatives 2 and 3.

c. Mainframe Operating Costs

This category reflects the estimated annual cost of using a mainframe computer for alternatives 1 and 2. These cost estimates are based upon the 1984 prices of

computer services set by the CDC Cybernet System in Rockville, Maryland [Ref. 16]. In the absence of a customer charge-back scheme at the MCCDPA, CDC prices were substituted in this analysis because they were considered representative of the actual costs of providing mainframe computer services. The estimated mainframe operating costs for the CAIS using either alternative 1 or 2 are listed by category in Appendix H.

3. Cost Summary

The costs of this project will extend beyond three years after the project inception date and therefore must be discounted to present values [Ref. 17: p. 9-1]. This action is appropriate because resources received today are worth more than those resources received in the future. Discounting permits cost streams with different time phasing to be compared more equitably. The discount rate prescribed by DOD is currently 10% [Ref. 18]. The application of this rate yields an assumed present value of future dollars for government expenditures. Since the discount rate excludes consideration of inflation, another factor must be introduced into the calculation of present values. This second factor is the differential inflation rate. Its value, also a percentage, reflects the anticipated difference between the actual rate and the normal rate of inflation. The differential inflation rate chosen for this analysis is 0%, meaning that actual inflation will not significantly vary from the normal rate of inflation during the CAIS life cycle [Ref. 19: p. 9-5 and Table D-6]. The cost elements associated with each alternative per fiscal year are presented in undiscounted dollars in Appendix I, and in present value terms (discounted at 10%) in Appendix J. The cumulative costs of each alternative are listed in Figure 5.1.

	$-Undiscounted	$-Discounted (present value)
Alternative 1	60,108	46,372
Alternative 2	43,649	32,468
Alternative 3	26,307	21,949

Figure 5.1 Cumulative Costs

These values indicate that alternative 3 has the lowest cost while alternative 1 has the highest cost. These characteristics remain unchanged as the undiscounted costs are adjusted to their present values.

F. BENEFIT ANALYSIS

1. Description

The principal benefits, which are expected in varying degrees from each of the feasible alternatives, are described below. Next to each benefit title is a numerical value (the importance value) representing the importance of that benefit in relation to the other benefits. Values were assigned from a range of 1 to 10, the former being the least desirable and the latter being the most desirable. The values will become necessary to quantify the benefits associated with each alternative for the purpose of comparison.

a. Ability to Rapidly Provide Casualty-Related Information During Sustained Operations (10)

No capability currently exists to support rapid access to information about several casualties at one time. For example, during the Beirut crisis, Senator John Glenn inquired about the identity of casualties whose home of

record was in Ohio [Ref. 20]. At that time the only means available to the Casualty Section to answer the question was to manually search each casualty record for the applicable information. Shortly after that question was answered, the Senator then asked how many of the casualties from Ohio were married. Another manual search of the total numbers of records took place! This example illustrates the flexibility that the Casualty Section must maintain during a crisis and the wide range of questions they are called upon to answer without delay. An effective implementation of current ADP technology can accommodate these types of inquiries with a speed not attainable by the manual system in use.

b. Improved Accuracy of Casualty-Related Data (10)

The original Personnel Casualty Report is prepared by the field commander and transmitted to HQMC. Most of the information contained in that report is not available anywhere except at the scene of the incident. During this evolution, the information is often transcribed at various points in the reporting chain as well as at the various units within the Casualty Section. Multiple regenerations of the casualty-related data increases the probability of error, an intolerable characteristic of the manual system. Properly designed computer systems nearly eliminate the probability of error in data as it is transmitted, compiled, and processed.

c. Improved Timeliness in Casualty Assistance to the Next of Kin (9)

The manual processing of casualty information requires an excessive amount of time between the initial notification of the next of kin and the mailing of the Casualty Package. The sooner a Casualty Package can be

compiled and mailed to the next of kin, the quicker the recipient may apply for appropriate benefits from the Marine Corps, the VA, and SGLI Corporation. Among the features of the ADP technology is a reduction in the amount of time users spend in acquiring and verifying information.

d. Increase in the Availability of Casualty-Related Data to Field Commanders (7)

Currently the Marine Corps field commanders become aware of casualty information via Naval messages or telephone conversations. As the CACO and others in the chain of command determine that various significant details of information about the casualty are inaccurate or need to be modified, phone conversations frequently provide amendments to current information with no update being made in any central place where the information is maintained. This creates inconsistencies in the information held at the various commands. One remedy would be to automate casualty information and thereby maintain consistency up and down the chain of command. This benefit is obtainable through current ADP technology.

e. Improved Use of Resources (7)

Augmenting the Casualty Section with personnel from other organizations within HQMC is the only relief measure available during a mass casualty incident. In reality, however, the Casualty Section personnel must still review and process each case. As the volume of casualties increases, time becomes the dominant factor which limits the quality of research performed or each casefile. Automating the information retrieval and verification tasks would allow more time for the Section personnel to review each case, even during a crisis. Current technology is available to reduce the time required to complete administrative tasks

and thereby improve the Section's capability to manage varying workloads.

f. Enhancement of the Internal Review Function (6)

The safeguarding of resources, specifically the casualty-related information which is protected by the the Privacy Act of 1974 or is considered sensitive due to its content is an Internal Review function. The current system is at high risk in this area due to the manner in which information is transmitted and stored. The use of ADP resources in protecting information, while not failsafe, has proven to be an effective security measure.

g. Improved Adaptaticn to Changes Caused by External Conditions (5)

The current system did not readily adapt to the variations in which input arrived at the Casualty Section. These differences in casualty reporting policies which were created to cope with the Beirut crisis required additional time to be spent in adapting tc different reporting procedures. Although these deviaticns in reporting were temporary, the Casualty Section fourd it difficult to integrate them with their established procedures. In a well-designed automated environment, procedures are structured to accommodate changes on either a temporary or permanent basis. The element of adaptability, while not a primary benefit, must be considered in light of the DOD-wide policies under which the Marine Corps must operate.

2. Quantificatien

Each stated benefit for each feasible alternative was considered by each panel member and then given a grade (the expected amount value). The assigned grade corresponds to the degree that particular benefit is expected from the

alternative. The grade was assigned from a range of 1 to 3, the former being the least amount of that benefit expected and the latter being the most. The final step in quantifying the benefits [Ref. 21: p. 15-4] was to multiply the importance value of each benefit by the expected amount value of that benefit for each alternative. This multiplication resulted in a weighted score for each benefit/alternative combination. The weighted scores were added for each alternative to obtain a total benefit score. Appendix K displays the relative weight value for each potential benefit and provides the raw and weighted scores for each alternative. The aggregate benefit values are listed in Figure 5.2.

	Total Benefit Score
Alternative 1	552
Alternative 2	657
Alternative 3	596

Figure 5.2 Aggregate Benefit Values

G. COMPARISON OF ALTERNATIVES

To determine if the alternatives will produce benefits commensurate with their associated costs, the Benefit Cost Ratio (BCR) technique was used. The ratio is formed by placing the weighted benefit score over the uniform annual cost [Ref. 22: pp. 15-3 to 15-5]. The result is a single value for each alternative which provides a basis for comparison. The higher the value, the more benefits will

accrue for each dollar of cost for that alternative. The derivation of these ratios is depicted in Appendix L and indicates the expected return of benefits per dollar of cost. The BCR values for each alternative are listed in Figure 5.3 indicating that the third alternative provides the most benefits per dollar invested.

	Benefit Cost Ratio
Alternative 1	.0666
Alternative 2	.1133
Alternative 3	.1520

Figure 5.3 Benefit Cost Ratios

H. SENSITIVITY ANALYSIS

The recommendation contained in this analysis was formed in a complex and unpredictable environment. The life span and cost elements associated with this study are among the most volatile of input factors. To complete this study, both of these elements were held constant. In reality, however, they are dynamic elements of the environment in which the decision-maker must select an alternative for the CAIS. To aid the decision-maker, a sensitivity analysis was performed to see how sensitive the recommendation is to changes in the input variables [Ref. 23: pp. 17-1 to 17-4]. The results of this analysis are described next.

1. Planning

An eight year life is a common span of production years for a computer system. Yet, this assumption may be invalid. The needs of the Marine Corps are changing as are the technologies being implemented to satisfy those needs. These changes may cause an early conclusion to the CAIS. If the life span for the CAIS was reduced by three years, the BCRs would change in value and possibly change in their relative order. This change would affect the decision-maker during the selection of an alternative for the CAIS. To test the sensitivity of this change, a planning factor of five years, vice the original eight, was introduced to the problem. The original recommendation was not sensitive to this change, as can be seen in Appendix M.

2. Costs

Costs were estimated using 1984 prices of analogous computer system products. This method assumed that ordinary off-the-shelf products could be integrated to construct the CAIS. This assumption may not hold if these products are later considered unsatisfactory or are no longer available at a reasonable cost. Therefore, the recurring and non-recurring costs were doubled to see their effect upon the recommendation. The effects, shown in Appendix N, were not sufficient to change the original recommendation.

3. Benefits

Of the benefits described in Section F.1. of this Chapter, none were considered adjustable for the purpose of conducting a sensitivity analysis. Since Casualty Section is operating in a manual fashion, it is inconceivable that any of the stated benefits would not accrue when automation is introduced to their situation. Therefore, the benefit factors were left intact during this phase of the study.

I. RECOMMENDATION

Based upon this analysis and specifically the Benefit Cost Ratio comparison, alternative 3, the networked microcomputers solution, is recommended for further conceptual development in compliance with Marine Corps Order P5231.1.

VI. CONCLUSION

The four documents presented in Chapters two through five of this thesis complete the concept development phase of the system life cycle for an automated information system for the Casualty Section, Headquarters, U.S. Marine Corps. In the research necessary to write the four documents, the initial questions which were posed in the Introduction have been answered. Those answers are summarized next.

1. As indicated in the Mission Element Needs Statement, the mission deficiencies of the Casualty Section are its inability to respond in a timely manner in cases of casualties during sustained operations to higher authorities and the media and at the same time to notify the next of kin of a casualty. The exploration of alternatives is justified.
2. The requirements of the Casualty Section, as noted in the Requirements Statement, do contain sufficient quantitative and qualitative detail to validate the project.
3. The alternative solutions which were discussed in the Feasibility Study satisfy the operational, technical, and economic feasibility completely and with varying strengths.
4. The Economic Analysis describes in detail the relative worth of each feasible alternative in terms of costs, benefits, and uncertainties. Alternative 3 is the optimum alternative.

The conclusion of this thesis is that an automated information system for the Casualty Section be pursued, that alternative 3 be recommended, and that the design phase of

the project be initiated. These recommendations will be presented to the Deputy Chief of Staff, Manpower Division, Headquarters, U.S. Marine Corps for approval to continue with the CAIS project.

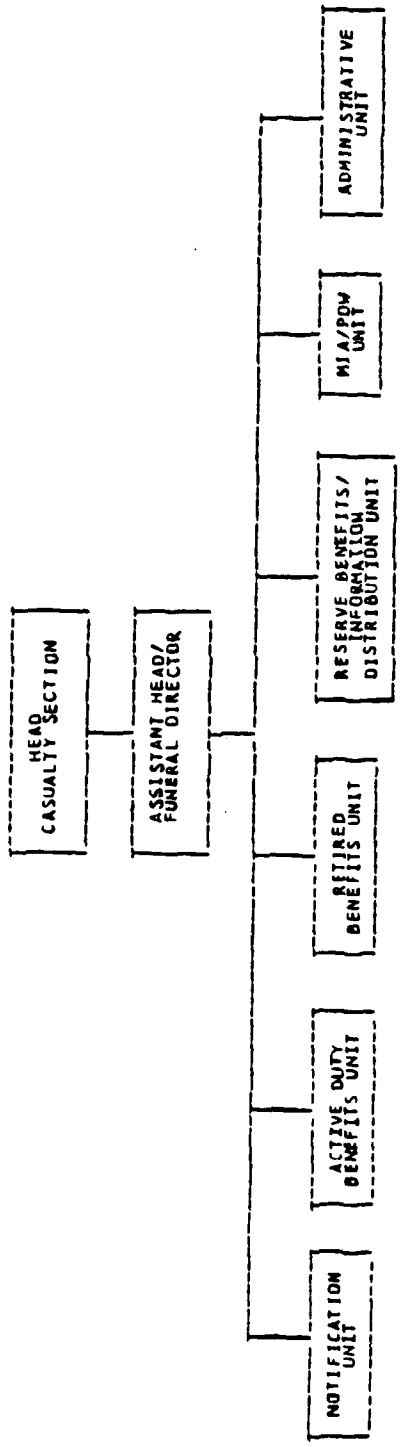
APPENDIX A
GLOSSARY

ADP	Autcmatic Data Processing
AIS	Autcmated Information System
avn	Automated Voice Network
BCR	Benefit Cost Ratio
CACO	Casualty Assistance Calls Officer
CAIS	Casualty Assistance Information System
CMC	Commandant of the Marine Corps
CONUS	Continental United States
CPU	Central Processing Unit
CRT	Cathode Ray Tube
DBMS	Database Management System
DDN	Defense Data Network
DMCC	Designated Monitored Command Code
DOD	Department of Defense
DON	Department of the Navy
EA	Econcmic Analysis
FBI	Federal Bureau of Investigation
FS	Feasibility Study
FY	Fiscal Year
HDQTRS	Headquarters
HMF	Headquarters Master File
HQMC	Headquarters of the Marine Corps
LOD	Line of Duty
MENS	Mission Element Needs Statement
MC	Marine Corps
MCC	Monitored Command Code
MCCDPA	Marine Corps Central Design and Programming Activity
MCD	Marine Corps District

MCDEC	Marine Corps Development and Education Command
MCFC	Marine Corps Finance Center
MCO	Marine Corps Order
MIA	Missing in Action
MMS	Manpower Management System
MOS	Military Occupational Specialty
NOK	Next of Kin
OQR	Officer Qualification Record
PCR	Personnel Casualty Report
PEBD	Pay Entry Base Date
PNOK	Primary Next of Kin
POW	Prisoner of War
PV	Present Value
REAL FAMMIS	Real Time Finance and Manpower Management Infcrmation System
RED	Record of Emergency Data
RS	Requirements Statement
RUC	Reporting Unit Code
SecNav	Secretary of the Navy
SGLI	Servicemens Grcup Life Insurance
SNOK	Seccndary Next of Kin
SRB	Service Record Book
SSN	Social Security Number
USMC	United States Marine Corps
VA	Veterans Administration
WW	World War

APPENDIX B

ORGANIZATIONAL STRUCTURE: CURRENT/GARRISON OPERATIONS



APPENDIX C

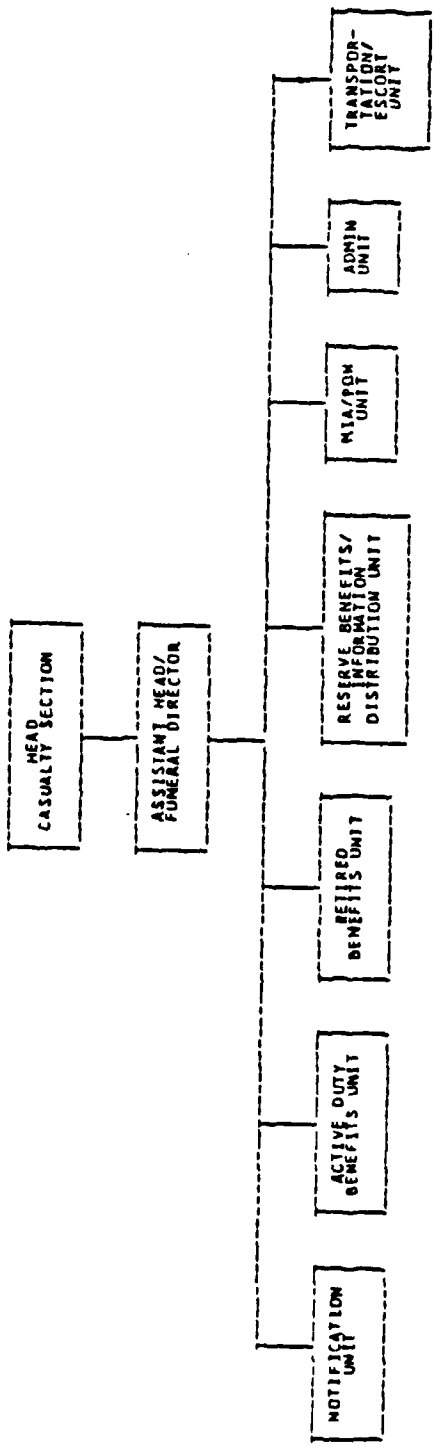
PERSONNEL CASUALTY RECORD DATA

The reference for fields 1-33 is MCO P3040.4B, Appendix A-1. The reference for fields 34-46 is the Requirements Statement, paragraph C.1.b.

	Field Name	Bytes Required
1.	Name	26
2.	SSN	10
3.	Grade/Rate	10
4.	Primary MOS	4
5.	Type of Casualty	15
6.	Casualty Status	3
7.	RUC/DMCC	5
8.	Category of Person Reported	20
9.	Sex	1
10.	Date of RED	10
11.	PNOK Info	80
12.	SNOK Info	80
13.	NOK not to be Notified	1
14.	Place of Incident	40
15.	Circumstances	1000
16.	LCD Investigation	1
17.	Status/Location of Remains	40
18.	Cause of Death	500
19	Place of Death	40
20	Date/Time Group of Death	15
21.	PEBD	6
22.	Basic Pay	7
23.	Incentive Pay	7
24.	Special Pay	7
25.	Religious Preference	6
26.	Decorations and Awards	200
27.	SGLI Info	200
28.	Date SGLI Form Sent	10
29.	Diagnosis and Condition	200
30.	Prognosis	20
31.	Place Hospitalized	60
32.	Remarks	200
33.	Category if Missing	100
34.	Nearest MC Activity to PNOK	40
35.	MCD assigned	2
36.	CACO 1 data	80
37.	CACO 2 data	80
38.	CACO 3 data	80
39.	Date of Confirmation	10
40.	Consecutive CACO updates	8000
41.	Funeral arrangements	200
42.	Escort(s) data	80
43.	Mortuary	60
44.	Date & Place of Interment	40
45.	Death Gratuity data	80
46.	Arrears in Pay data	80
47.	SGLI Election data	120

APPENDIX D

ORGANIZATIONAL STRUCTURE: SUSTAINED OPERATIONS



APPENDIX E

USMC CASUALTY STATISTICS

	WW II (1)	Korea (2)	Vietnam (3)	Total (4)
Battle Deaths	19733	4267	13067	37067 (2.0)
Other Deaths	4778	1261	1683	7722 (.04)
Total Deaths	24511	5528	14750	44789 (2.4)
Wounds not Mortal	67207	23744	51392	142343 (7.5)
Casualty Total	91718	29272	66142	187132 (9.9)
Total Serving	669100	424000	794000	1887100 (100)
Mo Ave (5)	10969	11459	7784	

NOTES:

(1) World War II - 7 December 1941 to 31 December 1946.

(2) Korea Conflict - 25 June 1950 to 27 July 1953.

(3) Vietnam Conflict - 4 August 1964 to 27 January 1973.

(4) Numbers in parentheses, in this column, indicate the percentage of the total serving during the conflicts. Casualties account for approximately 10% of the total force committed.

(5) The average of these monthly figures equals 10070. If 10% were casualties, approximately 1000 casualty records would be created in any given month during sustained operations.

APPENDIX F
REQUIRED EQUIPMENT

FUNCTICNAL CATEGORY

ACTIVITY	INPUT/OUTPUT	HOST	STORAGE	COMMUNICATION
CASUALTY SECTION	Keyboard(10) Monitor (10) Printer (4)	Mini-computer(1)	Disk(1)	Modem(10) Controller(1)
DISTRICT HDQTRS.	Keyboard(1) Monitor (1) Printer (1)	n/a	n/a	Modem(1)
FIELD COMMAND	Keyboard(1) Monitor (1) Printer (1)	n/a	n/a	Modem(1)
MCCDPA	n/a	Mainframe Computer(1)	Disk(1)	Controller(1)

NOTE: Numbers in parentheses irdicate quantity.

APPENDIX G

FEASIBILITY ASSESSMENT MATRIX

CATEGORIES	ALTERNATIVES					
--TECHNICAL--	1	2	3	4	5	6
HARDWARE						
MEMORY	Y	Y	Y	N	Y	Y
ACCESS	Y	Y	Y	N	N	N
FLEXIBILITY	Y	Y	Y	N	Y	Y
FAULT TOLERATION	Y	Y	Y	N	N	N
DESIGN HISTORY	Y	Y	Y	N	Y	Y
AVAILABILITY	Y	Y	Y	N	Y	Y
LONGEVITY	Y	Y	Y	N	Y	Y
SOFTWARE						
APPLICATIONS	Y	Y	Y	N	Y	Y
RESPONSE TIME	Y	Y	Y	N	Y	Y
TRANSPORTABLE	Y	Y	Y	N	Y	Y
MAINTENANCE	Y	Y	Y	N	Y	Y
HUMAN INTERFACE	Y	Y	Y	N	Y	Y
AVAILABILITY	Y	Y	Y	N	Y	Y
COMMUNICATIONS						
COMPATIBILITY	Y	Y	Y	N	Y	Y
AVAILABILITY	Y	Y	Y	N	Y	Y
--OPERATIONAL--						
STRATEGY	Y	Y	Y	N	Y	Y
PERSONNEL	Y	Y	Y	N	Y	Y
POLICY	Y	Y	Y	N	Y	Y
FLEXIBILITY	Y	Y	Y	N	Y	Y

NOTE: Y = YES, N = NO

APPENDIX H
MAINFRAME OPERATING COSTS

Cost Item	Estimated Annual Usage	Cost Basis	Cost Estimate
Connect Charges	26 hours	$9/hour	$ 234
Data Transfer	400,000 char	$.25/1000 char	100
Batch Setup and Execution	12 hours	$30/hour	360
Permanent File Storage	1,000,000 char for 8 months	$6.42/day	1541
On-Line File Storage	1,000 for 4 months	$200/month	800
Billing Units	1200	$.42/unit	504
Total Estimated Annual Cost			$ 3539

UNDISCOUNTED COSTS

Alternative 1

Cost Element	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93	Total
Non-recurring										
Equipment Purchase	11880	0	0	0	0	0	0	0	0	11880
Software Purchase	2500	0	0	0	0	0	0	0	0	2500
Recurring										
Equipment Maintenance	0	1782	1782	1782	1782	1782	1782	1782	1782	14256
Software Maintenance	0	395	395	395	395	395	395	395	395	3160
Mainframe Operation	0	3539	3539	3539	3539	3539	3539	3539	3539	28312
TOTAL	14380	5716	5716	5716	5716	5716	5716	5716	5716	60108

APPENDIX I

UNDISCOUNTED COSTS

Alternative 2

Cost Element	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93	TOTAL
Non-recurring										
Equipment Purchase	5430	0	0	0	0	0	0	0	0	5430
Software Purchase	995	0	0	0	0	0	0	0	0	995
Recurring										
Equipment Maintenance	0	815	815	815	815	815	815	815	815	6520
Software Maintenance	0	299	299	299	299	299	299	299	299	2392
Mainframe Operation	0	3539	3539	3539	3539	3539	3539	3539	3539	28312
TOTAL	6425	4653	4653	4653	4653	4653	4653	4653	4653	43649

UNDISCOUNTED COSTS

Alternative 3

Cost Element	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93	TOTAL
Non-recurring										
Equipment Purchase	11500	0	0	0	0	0	0	0	0	11500
Software Purchase	295	0	0	0	0	0	0	0	0	295
Recurring										
Equipment Maintenance	0	1725	1725	1725	1725	1725	1725	1725	1725	13800
Software Maintenance	0	89	89	89	89	89	89	89	89	712
TOTAL	11795	1814	1814	1814	1814	1814	1814	1814	1814	26307

APPENDIX J

PRESENT VALUE ANALYSIS

Item	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93	TOTAL
Nonrecurring										
Alt 1	14380	0	0	0	0	0	0	0	0	14380
Alt 2	6425	0	0	0	0	0	0	0	0	6425
Alt 3	11795	0	0	0	0	0	0	0	0	11795
Recurring										
Alt 1	0	5716	5716	5716	5716	5716	5716	5716	5716	45728
Alt 2	0	4653	4653	4653	4653	4653	4653	4653	4653	37224
Alt 3	0	1814	1814	1814	1814	1814	1814	1814	1814	14512
Total Undiscounted										
Alt 1	14380	5716	5716	5716	5716	5716	5716	5716	5716	60108
Alt 2	6425	4653	4653	4653	4653	4653	4653	4653	4653	43649
Alt 3	11795	1814	1814	1814	1814	1814	1814	1814	1814	26307
Discount Factor (Applied discount rate of 10% and differential inflation rate of 0%).	1.0	.954	.867	.788	.717	.652	.592	.538	.489	
Total Discounted (Present Value)										
Alt 1	14380	5453	4956	4504	4098	3727	3388	3075	2795	46372
Alt 2	6425	4439	4034	3667	3336	3034	2755	2503	2275	32468
Alt 3	11795	1731	1573	1429	1301	1183	1074	976	887	21949

APPENDIX K

AGGREGATE BENEFIT VALUES

Benefit Description	Relative Weight	Raw Scores			Weighted Scores		
		Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3
A. Ability to rapidly provide casualty-related information during sustained operations	10	12	12	11	120	120	110
B. Improved accuracy of casualty-related data	10	11	12	11	110	120	110
C. Improved timeliness in casualty assistance to the next-of-kin	9	10	13	12	90	117	108
D. Increase the availability of casualty-related data to field commanders	7	9	14	14	63	98	98
E. Improved use of resources	7	8	13	11	56	91	77
F. Enhancement of the internal review function	6	13	11	8	78	66	48
G. Improved adaptation to changes caused by external conditions	5	7	9	9	35	45	45
TOTAL					552	657	596

APPENDIX L
BENEFIT COST RATIO ANALYSIS

Alternative Number	Total Benefit Value (*)	Uniform Annual Cost (**)	Benefit Cost Ratio (***)
1	552	$8285	.0666
2	657	$5801	.1133
3	596	$3922	.1520

Notes:

* See Appendix K for details.

** Uniform Annual Cost = PV/Cumulative Discount Factor of 5.597.

*** Benefit Cost Ratic = Total Benefit Value/Uniform Annual Cost.

APPENDIX M

SENSITIVITY ANALYSIS: SYSTEM LIFE

Benefit Cost Ratio Sensitivity to a 5 Year System Life

Alternative Number	Total Benefit Value (*)	Uniform Annual Cost (**)	Benefit Cost Ratio (***)
1	552	$9333	.0591
2	657	$6270	.1048
3	596	$4780	.1247

Notes:

* See Appendix K for details.

** Uniform Annual Cost = PV/Cumulative Discount Factor of 3.977.

*** Benefit Cost Ratio = Total Benefit Value/Uniform Annual Cost.

APPENDIX N
SENSITIVITY ANALYSIS: COST

Benefit Cost Ratio Sensitivity to 100% Increase in Costs

Alternative Number	Total Benefit Value (*)	Uniform Annual Cost (**)	Benefit Cost Ratio (***)
1	552	$16570	.0333
2	657	$11602	.0566
3	596	$ 7844	.0760

Notes:

* See Appendix K for details.

** Uniform Annual Cost = PV/Cumulative Discount Factor of 5.597.

*** Benefit Cost Ratio = Total Benefit Value/Uniform Annual Cost.

LIST OF REFERENCES

1. U.S. Department of Defense Instruction, Military Personnel Casualties Notification and Assistance to Next of Kin, DoD Instruction 1300.9, 23 March 1973.

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